22.4 Electric fields

1. Give an example of a physical field. The quantity may be a scalar or a vector. (Nope, don't use my examples. Come up with something, or do a search.)

2. In a lightning storm, a charged raindrop carrying $+10\mu$C of charge experiences an electrical force of 0.30N the $+z$ direction. Calculate the

   (a) electric field at this point.
   (b) force on a -5μC raindrop.

   Note: Fields of 10^2, 10^3 N/C are common. Fields of 3 MN/C will tear electrons from air molecules. Answers: 30kN/C in +x, -0.15N in -x.

3. The Earth's electric field near the surface is about 120 N/C pointing down. A bit of charged stray paper of mass m_0 is found to "float" in this field.

   (a) Draw a force diagram.
   (b) Are electrons added or removed to the paper?
   (c) How many electrons? Leave this as an expression.

   Note: This is not the cleanest example since there are other forces at play here, primarily air resistance. Answer: number of electrons $= mg/eE_{\text{Earth}}$

4. An electric field of strength E_0 points in the $+x$ direction. The ball has a mass m and charge $+q$.

   (a) Draw a force diagram for the ball.
   (b) Determine the charge on the ball.

   Answer: $q = (mg\tan\theta)/E$

23.1 23.2 Electric field models, electric field of point charges

1. Read 23.1. Write the equations for the "four key electric fields". For label each equation with the types of charges that create them.

2. Read 23.1. What is meant by a *model*, as used in physics or engineering? Your answer can be an example.

3. Read 23.2. Charges q_1 and q_2 are point charges. Determine the electric field at the origin.

4. What is meant by *limiting case*, in physics and engineering? Your answer can be an example.

5. Draw the *electric field lines* for
   (a) positive point charge
   (b) dipole.
   Don't include field vectors.